Spring-turning apparatus

Technical Field

The invention relates to a spring-turning apparatus according to the precharacterizing clause of Patent Claim 1. It furthermore relates to a method for forming rows of springs according to the precharacterizing clause of Patent Claim 11 and to a spring-transporting apparatus according to the precharacterizing clause of Patent Claim 14.

Prior Art

During the production of spring cores for mattresses, paddings or seat cushions, springs are coiled in a spring-coiling machine, are delivered via a spring-turning station to a spring-transporting apparatus and are supplied by the latter to a processing or assembly station where the individual springs are connected to one another. The spring-turning station carries out the task here of delivering the individually finished springs to the transporting apparatus in a manner such that they are oriented in a manner suitable for processing and such that they are precisely positioned.

EP-A-0'774'309 discloses a spring-turning apparatus in which the coiling machine delivers the springs in a holding position individually to arms of a multiarmed transporter, the transporting star is rotated in a constant cycle into a delivery position and each spring is placed individually between two revolving continuous loops. The two continuous loops have a vertically running section which merges into a horizontally running section. A spring-transporting conveyor

comprising an upper and a lower horizontally running belt conveyor is adjacent to this horizontally running section. The said belt conveyor takes over the spring and supplies it to the processing station. The rotation of the belts that arises in the process has the disadvantage that springs may be displaced. In addition, the springs cannot be delivered in any desired rotational position but rather all have the same direction of rotation.

WO 2004/011173 discloses a device for orienting springs while being transported from a spring-coiling machine to a spring core mounting machine which comprises a rotating table for the springs.

DE-A-199'50'401 discloses a device for rotating the springs which consists of a pivotal centre having three arms.

WO 02/38304 discloses a rotatable wheel with receiving pockets, in which the springs are passed on to the conveyor belt in a lying manner.

Furthermore, it is mentioned in EP-A-0'774'309 that the two continuous loops which hold the springs under compression are driven synchronously with each other by means of a servodrive. It should thus be possible to operate different strokes and therefore to individually select the distances between the individual springs and spring groups. This apparatus has the disadvantage that the entire belt and therefore all of the spring groups situated on the belt always have to be driven with a relatively large or relatively small stroke. The forces acting on the springs may thus lead to a displacement of the springs as the compression of the belts decreases. In addition, the system is more susceptible to breakdowns, since the constant stroke change is relatively difficult to bring about.

Summary of the Invention

It is therefore an object of the invention to provide a spring-turning apparatus which ensures that the springs are securely transported and which permits a greater flexibility in the positioning of the springs.

This object is achieved by a spring-turning apparatus having the features of Patent Claim 1.

The spring-turning apparatus according to the invention has a cassette wheel which can be rotated about an axis and has at least one cassette compartment. In a first rotational position of the cassette wheel, a spring can be introduced into the at least one cassette compartment. In a second rotational position, the spring can be delivered to a spring-transporting apparatus, there being a transfer element for the delivery.

There are preferably a plurality of cassette compartments, so that, in each case simultaneously, a first cassette compartment is situated in the first position and a second cassette compartment in the second position. As a result, the transfer process can take place without any time delay.

The spring-turning apparatus preferably has rotary plates between which a spring can be held in each case. As a result, each spring can be rotated individually into its desired rotational position before it is delivered to the spring-transporting apparatus. Thus, for example, each spring can be rotated individually through a desired angle. This enables rows of springs to be formed, the outer springs of which are always oriented in such a manner that their free ends are directed towards the adjacent rows and therefore cannot protrude outwards. This orientation prevents free ends

of the springs from being able to damage the cushion or padding covers.

It is possible to arrange these rotary plates in the cassette compartments. However, in a preferred embodiment, these rotary plates are situated in a transfer unit which is arranged between a multiarmed transporting star and the cassette wheel. This transfer unit is preferably arranged pivotably, so that it can bridge the distance between the transporting star and cassette wheel during the delivery of the springs.

It is furthermore advantageous that the springs can be positioned in a relatively precise manner in the rotary cassette, thus enabling the delivery to the spring-transporting apparatus to take place with the same precision. A further advantage is that the cassette requires a relatively small amount of space and the size of the system is therefore minimized.

It is a further object of the invention to provide a method and an apparatus which facilitate the formation of rows of springs in any desired positions and minimize the susceptibility of the system to breakdowns.

This object is achieved by the method and the apparatus having the features of Patent Claims 11 and 14, respectively.

In the case of the method according to the invention for forming rows of springs and in the case of the spring-transporting apparatus according to the invention, the springs are supplied individually and are delivered at a lower delivery point to a spring conveyor, the relative position of this lower delivery point with respect to the spring conveyor being changed.

This changing of the position preferably takes place by means of an intermediate or transfer conveyor which, in the delivery region, runs parallel and adjacent to the spring conveyor. As a result, individual springs can be delivered to this transfer conveyor and brought to the desired lower delivery point without the conveying speed or the cycle of the spring conveyor, on which the springs which are already arranged in rows are situated, having to be interrupted. Since the transfer conveyor can be of relatively short design, the forces which act on its mechanism are significantly smaller.

In addition, this type of transfer makes it possible for the springs to be able to be positioned relatively precisely on the transfer conveyor. This precision is taken on by the spring conveyor, so that a later orientation of the springs shortly before or during their delivery to a processing or assembly station can be omitted.

Further advantageous variants of the invention and further advantageous embodiments emerge from the dependent patent claims.

Brief description of the drawings

The subject matter of the invention is explained below with reference to a preferred exemplary embodiment which is illustrated schematically in the attached drawings, in which:

Figure 1 shows a view from above of the turning apparatus according to the invention and of the units adjoining it;

Figure 2 shows a perspective view of the turning apparatus according to Figure 1 including the spring-transporting apparatus;

Figure 3a shows a side view of the transfer unit according to Figure 2 in a depositing position;

Figure 3b shows the transfer unit according to Figure 3a in a delivery position;

Figure 4 shows the elements according to Figure 1 from the side, and

Figures 5a to 5f show schematic illustrations of the delivery of spring to the transporting device in six steps.

Ways of implementing the invention

Figure 1 illustrates a turning apparatus according to the invention. Springs F which are supplied by a spring-coiling machine (not illustrated) are grasped individually by a transporting star 1. For this purpose, the transporting star 1 has a plurality of gripping arms 10, only one of these gripping arms 10 being illustrated in Figure 1. At its free end, the gripping arm 10 has a clip 11 in which the spring F can be held in a fixed manner.

The transporting star 1 rotates about its axis, as a result of which the springs F, which are held individually, pass through finishing stations. For example, an end ring is bent towards them in a first rotational position or the spring is bound together, and in a second rotational position they are hardened, for example.

In a last rotational position, the gripping arm 10 delivers the spring F to a transfer unit 2. This transfer unit 2 is mounted pivotably and pushes the spring F into a cassette compartment 30 of a cassette

wheel 3. Rotation of the cassette wheel 3 about a central axis 31 causes the spring F to be rotated from its previous horizontal, lying orientation into a vertical, standing orientation and to be brought to a spring-transporting apparatus T. A transfer element or delivery means 32 pushes the spring F, which is now standing, into the spring-transporting apparatus T from where it is conveyed into the processing and assembly station (not illustrated in the figures).

The spring-transporting apparatus T is explained once again in more detail later on in the text with reference to Figures 1 and 4. In the following text, the turning apparatus according to the invention is discussed first.

In Figure 2, the transfer unit 2 and the cassette wheel 3 can be readily seen. The transfer unit 2 has two mutually opposite clamping plates 20. They are preferably arranged at an angle to each other at least in their region directed towards the direction of movement of the transporting star 1, so that they form an opening which slightly expands in this direction. In this embodiment, the opening is directed downwards. Rotary plates 21, the surfaces of which are aligned with the inner surface of the clamping plates 20, are embedded in the clamping plates 20. The transfer unit 2 furthermore has at least one, preferably two, transfer elements in the form of pivoting flags 22. Each pivoting flag 22 has a pivotable arm 220 and a sliding plate 221, which is arranged on it and is slit in a V-shaped manner. The shape of the sliding plate 221 can be adapted or selected in accordance with the shape of the springs F.

Figures 3a and 3b illustrate the two extreme positions of the transfer unit 2. These can also be seen in Figure 2, the movement of the transfer unit 2 being

indicated here by an arrow and the second extreme position only being illustrated by chain-dotted lines.

In the position according to Figure 3a, the said transfer unit is situated in the rear position remote from the cassette wheel 3. In this position, the spring F is delivered to the transfer unit 2 by rotation of the transporting star 1. In Figure 3a, the front end of the gripping arm 10 can be seen. The arrow shows the direction of movement of the gripping arm 10 and the spring F, which is illustrated by dashed lines, or the gripping arm 10, which is illustrated by dashed lines, shows the position at which the spring F is released by the clip 11 and is clamped between the two clamping plates 20 or between the two rotary plates 21. In this position, the spring F is slightly pressed together and is therefore held resiliently.

The transfer unit 2 is now pivoted about its axis 23 towards the cassette wheel 3. At the same time, the spring F can be brought by means of rotation of the rotary plates 21 via servomotors into any desired rotational position. This rotation does not have to take place during each transfer of a spring F; rather, it depends on the type and ensuing position of the spring in the finished padding. For example, each spring which, in the finished padding, comes to rest at one end of a row can be rotated in such a manner that its free end is directed towards the row. The rotary plates, and also all of the other elements, described previously and below, of the transporting star, of the turning apparatus and of the spring conveyor are driven and controlled preferably in accordance with a common, central control. The movements of the transporting star 1, of the transfer unit 2 and of the cassette wheel 3 preferably take place cyclically during the cycle of the spring-coiling machine.

In the end position which is illustrated in Figure 3b and which the clamping plates 20 in the cassette wheel 3 have reached, the pivoting flags 22 are pivoted further towards the wheel 3, so that they push the spring F away from the clamping plates 20 into the cassette compartment 30.

As can be seen in Figure 2, each cassette compartment 30 has two opposite walls between which the spring F is held under compression. In order to transfer the spring, the cassette wheel 3 rotates about its central axis 31 in the direction of the arrow, so that the spring F can be brought into a position rotated through 90°. In this position, they are delivered individually to the spring-transporting apparatus T.

This delivery can be seen in Figures 1 and 4. The cassette wheel 3 has at least one transfer element 32. Each cassette compartment 30 preferably has its own transfer element 32. This is, as illustrated in Figure 1, a pivotably mounted sliding arm with a, for example, V-shaped notch for better guidance of the spring F. The sliding arm 32 is mounted pivotably about the axis 33. If the cassette compartment 30 has reached the desired rotational position, the sliding arm 32 is activated and the spring F is pushed out of the cassette compartment 30 into a transfer conveyor 4.

This transfer conveyor 4 has a lower transfer conveyor belt 40 and an upper transfer conveyor belt 41. The two belts are endlessly revolving conveyors which are, however, preferably operated synchronously with each other. Figure 4 illustrates the respective first deflection pulleys 42 and the second deflection pulleys 43 around which the conveyor belts 40, 41 revolve. This transfer conveyor 4 is preferably operated by means of servomotors and preferably operates cyclically. However, other types of operation are possible. For example, the transfer conveyor may also be operated

continuously. The individual springs F are slightly compressed by means of the second belt conveyors 40, 41 and are therefore transported, held under compression, by means of the transfer conveyor 4 in the direction of the arrow.

The transfer conveyor 4 runs parallel, at at least approximately the same height as and adjacent to a spring conveyor 6. It extends at least in some sections, namely in the region of the upper and lower delivery points A, B, parallel to the spring conveyor 6. The spring conveyor 6 preferably likewise comprises two revolving, synchronously operated belt conveyors, the upper spring conveyor belt in Figure 4 being provided with the reference number 60 and the lower belt being provided with the reference number 61. The first deflection pulleys 62 can be seen in Figure 4, the second deflection pulleys are not illustrated. Springs F which are situated on the spring conveyor 6 are likewise fixed between the two belts by resilient clamping and are transported in the direction of the arrow. The drive of the spring conveyor 6 is preferably cyclic. A servomotor may be used for this. However, it is also possible to couple the spring conveyor 6 mechanically to the spring-coiling machine and to operate it in the same cycle.

The transfer of the individual springs F from the transfer conveyor 4 onto the spring conveyor 6 preferably takes place by means of a change unit 5. The change unit 5 has a pivoting frame 50 with vertically running legs 51 and a horizontally running guide rod 52 arranged between the legs. A second delivery means in the form of a clamp 53 is arranged in a laterally displaceable manner on this guide rod 52. The clamp 53 has, at its free end facing the transfer conveyor 4, a stop surface 54 which runs at least approximately perpendicularly to the conveying direction of the transfer conveyor 4 and which is directed towards that

delivery point A of the transfer conveyor 4 which is at the top in the conveying direction.

The clamp 53 is displaced along the guide rod 52 by means of a motor as determined by the central control. The drive or deflection pulley 55 used for this and the revolving toothed belt 56 are illustrated in Figure 4 by chain-dotted lines.

The transfer of the individual springs F is described below:
After a spring F has been pushed from the cassette wheel 3 onto the transfer conveyor 4, the transfer conveyor 4 is moved at a relatively high speed in the direction of the arrow until the spring F reaches the clamp 53 or a position predetermined by the control. The transfer conveyor 4 is stopped again and the clamp 53 is pivoted in the direction of the spring conveyor 6 by means of the pivoting frame 50. As a result, the spring F is delivered at a lower delivery position B from the transfer conveyor 4 to the spring conveyor 6. During this delivery, the two conveyors 4, 6 are preferably at a standstill. The spring conveyor 6 then continues in its customary cycle and the transfer conveyor 4 takes over the next spring F supplied by the cassette wheel 3 and conveys it to the clamp 53. In the meantime, the clamp 53, owing to its lateral displaceability, can now move to a different lower delivery position B relative to the spring conveyor 6.

In one variant of the method, the transfer conveyor 4 is not completely stopped, rather continues to run at a reduced speed during the transfer. In this case, the spring F is kept in its position owing to the stop surface 54.

In a preferred alternative of the method, the transfer conveyor 4 is being always operated in the same cycle. Thereby its velocity is several times higher than the

velocity of the spring conveyor 6. During transport of the spring F to the lower delivery point B the transfer conveyor drives further than the actual delivery point B. However, the clamp 53 stops the spring F at the lower delivery point B, so that the transfer conveyor 4 drags under the spring F. It waits in that position until the spring conveyor 6 reaches its desired position. If that is the case, the spring F will be delivered to the spring conveyor 6. Preferably the frequencies of the conveyors 4, 6 are such, that during the delivery at least the spring conveyor 6, preferably also the conveyor 4, stand still between two cycles.

Only one single spring F is preferably ever situated on the transfer conveyor 4. However, it is also possible to transport two or more springs F simultaneously on the transfer conveyor 4, since the conveying speed of the transfer conveyor 4 relative to the conveying speed of the spring conveyor 6 can be selected freely.

Figures 5a to 5f schematically illustrate a delivery of the springs. In Figure 5a, a first spring F1 has been delivered to the transfer conveyor 4. In Figure 5b, it has been transported to the clamp 53 and waits in a first lower delivery point B1 for its transfer. At the same time, a second spring F2 is already waiting for its delivery. In Figure 5c, the first spring F1 has been delivered to the spring conveyor 6 and the transfer element 52 has been pivoted towards the second spring F2. In Figure 5d, this second spring F2 is now delivered to the transfer conveyor 4. At the same time, the spring conveyor 6 has continued to move in an ever constant cycle. While the second spring F2 has been delivered to the transfer conveyor 4, the clamp 53 has also been displaced to the desired, new, lower transfer point B2, as can be seen in Figure 5e. According to Figure 5f, the second spring F2 can now be conveyed up to this point and delivered there, with a third spring F3 already being made ready again. As a result, any

desired groupings of springs F can be formed on the spring conveyor 6 and the distances between individual springs and the distances between spring groups can be selected as desired. Nevertheless, the spring conveyor 6 can be operated in a constant cycle.

In a further embodiment (not illustrated here), the individual springs are pushed directly from the cassette compartment 30 between the belts of the spring conveyor 6. In order to attain any desired groupings and distances between the springs on the spring conveyor 6 in this case, the spring conveyor 6 can be operated by means of a servomotor. However, it is also possible to already carry out a prepositioning process in the cassette wheel 3 by, for example, each spring F being displaced laterally to a desired position during its transportation in the associated cassette compartment and the delivery point from the cassette wheel to the spring conveyor therefore being changed.

Furthermore, it is possible to deliver the spring F to a conveyor apparatus configured in a different manner. In a further embodiment, although the transfer of the individual springs from the transfer conveyor to the spring conveyor takes place as described above, the delivery of the springs to the transfer conveyor is obtained with a means other than the rotary cassette.

The spring-turning apparatus according to the invention increases the flexibility in the delivery of springs from a spring-coiling machine into a processing station. The method according to the invention for forming rows of springs and the spring-transporting apparatus according to the invention permit a flexible arrangement of the springs while at the same time minimizing operational breakdowns of the machine.

List of reference numbers

F	Spring
F1	First spring
F2	Second spring
F3	Third spring
T	Spring-transporting apparatus
A	Upper delivery point
B	Lower delivery point
B1	First lower delivery point
B2	Second lower delivery point
1	Transporting star
10	Gripping arm
11	Clip
2	Transfer unit
20	Clamping plate
21	Rotary plate
22	Pivoting flag
220	Arm
221	Sliding plate
23	Axis
3	Cassette wheel
30	Cassette compartment
31	Central axis
32	Sliding arm
33	Axis
4	Transfer conveyor
40	Lower transfer conveyor belt
41	Upper transfer conveyor belt
42	First deflection pulley
43	Second deflection pulley
5	Change unit
50	Pivoting frame

	51	Leg
	52	Guide rod
	53	Clamp
	54	Stop surface
5	55	Pulley
	56	Toothed belt
	6	Spring conveyor
	60	Upper spring conveyor belt
10	61	Lower spring conveyor belt
	62	First deflection pulley